

(11) (A) No. 1,108,317

(45) ISSUED 810901

(52) CLASS 361-2

(51) INT. CL. B03D 1/02²

(19) (CA) **CANADIAN PATENT** (12)

(54) USE OF ANIONIC SURFACTANTS TO AID IN COAL/WATER
SEPARATION

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(21) APPLICATION No. 322,985

(22) FILED 790308

No. OF CLAIMS 4 - NO DRAWING

ABSTRACT

The invention comprises a method of improving the separation of coal fines from water in froths produced by frothing coal with methylisobutyl carbonol and a hydrocarbon liquid which comprises treating said froth containing the fines with a surfactant from the group consisting of fatty sulfosuccinates, sulfated alpha olefins, and alkaryl sulfonates and then separating said fines from the water by either sedimentation or filtration or centrifugation or a combination of these unit operations.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of improving the separation of coal fines from aqueous floats or froths produced by frothing coal with methylisobutyl carbonol and a hydrocarbon liquid which comprises treating said float containing the fines with a surfactant from the group consisting of fatty sulfosuccinates, sulfated alpha olefins, and alkaryl sulfonates and then extracting said fines from the float by sedimentation, filtration or centrifugation.
2. The method of Claim 1 where the surfactant is used in combination with from 5 - 80% by weight of a hydrocarbon liquid.
3. The method of Claim 1 where the fatty sulfosuccinate is a dioctyl sulfosuccinate.
4. The method of Claim 1 where the alkaryl sulphonate is a dodecyl benzene sodium sulphonate.

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PATENT AGENTS

This invention relates to the recovery of coal fines. More specifically, it relates to a process of recovering finely divided coal made floatable by the use of a frothing agent which renders these particles more hydrophobic in character.

In the processing of coal, there is inevitably formed some very finely divided particles of coal and clay. Such finely divided particles pass through the wet sieving process as a slurry. Since there is a considerable amount of coal in such slurries, efforts are made to recover as much as possible. Of particular relevance to this invention is the recovery process which involves flotation of the coal fines coincident with the settling of the clay fines.

A common frothing or flotation agent is methylisobutyl carbonol (MIBC) which is used in conjunction with a hydrocarbon liquid such as kerosene or a mineral oil. This flotation agent apparently causes the fine coal particles in the aqueous slurry to be rendered sufficiently hydrophobic to float.

Centrifugation of the float or froth is sometimes used as a means of concentrating or dewatering the coal fines. However, separation is incomplete because of the hydrophobic nature of the coal. This results in substantial losses of valuable coal. If it were possible to treat the froth containing finely divided hydrophobic coal with chemicals to improve the extractability of water from such fines, an improvement in the art of coal processing would be afforded.

THE INVENTION

The invention comprises a method of improving the separation of coal fines from water in froths produced by frothing coal with methylisobutyl carbonol and a hydrocarbon liquid which comprises treating said froth containing the fines with a surfactant from the group consisting of fatty sulfosuccinates, sulfated alpha olefins, and alkaryl sulfonates and then separating said fines from the water by either sedimentation or filtration or centrifugation or a combination of these unit operations.



The SurfactantsThe Sulfosuccinate Esters

The sulfosuccinate esters used in the practice of the invention may be either a mono alkyl sulfosuccinate or a dialkyl sulfosuccinate. The dialkyl sulfosuccinates are the preferred compounds. The compounds are most commonly synthesized by reacting maleic anhydride with a fatty alcohol, followed by a further reaction with sodium bisulfite, which, in turn, is followed by product isolation and purification as required. The synthesis of these types of compounds is rather straight forward and is not the subject of this invention.

When the monoalkyl sulfosuccinates are used, the alkyl group should contain between 6 and 18 carbon atoms in an aliphatic grouping and may be either straight or branch-chained or even cyclical.

When the dialkyl sulfosuccinates are employed, the alkyl groups should each contain between 6 - 12 carbon atoms with dioctyl sulfosuccinate representing a preferred compound.

Listed below are typical mono and dialkyl sulfosuccinates which may be used in the practice of the invention:

Monoalkyl Sulfosuccinates.

Octyl sulfosuccinate

Octyl sodium sulfosuccinate

Potassium dodecyl sulfosuccinate

Lauryl sodium sulfosuccinate

Cyclohexyl sulfosuccinate

2-ethyl hexyl sulfosuccinate

Ammonium myristyl sulfosuccinate

Dialkyl Sulfosuccinates

Diethyl sulfosuccinate, N_a salt

Dicyclohexyl sulfosuccinate, N_a salt

Diheptyl sulfosuccinate, Ammonium salt

Dilauryl potassium sulfosuccinate

The sulfosuccinates of the invention may be used either as their water-soluble salts such as the sodium, potassium, or ammonium salts, or they may be used in the free acid form.

The alkyl group that derives from the fatty alcohol used can be anywhere from a C_6 to a C_{18} alcohol. The alkyl group may also contain branching, cycloalkyl functionality, aryl substitution, and additional unsaturation. A preferred diester is commonly referred to as dioctylsulfosuccinate (hereafter referred to as DOSS) and is generally synthesized by reacting two moles of 2-ethyl hexanol with one mole of maleic anhydride under acid catalysis, followed by the reaction of sodium bisulfite.

The Alkaryl Sulfonates

These materials are the monoalkyl substituted benzenes which have been sulfonated usually with SO_3 . The alkyl group should contain at least 6 carbon atoms although, preferably, it contains 12 - 18. A preferred material is dodecyl benzene sodium sulfonate.

The Alpha Olefin Sulfonates

These materials are prepared by sulfating higher alkyl alpha olefins which contain at least 6 and, preferably, 12 - 18 carbon atoms.

Preferred Surfactant Compositions

The preferred surfactant compositions of the invention are the surfactants described above used in combination with from 5 - 80% by weight and, preferably, 20 - 60% by weight, of a hydrophobic

organic liquid which, in a preferred embodiment of the invention, is a petroleum hydrocarbon liquid exemplified by kerosene, light fuel oils, naphthas, and the like. For some unexplained reason, the hydrophobic liquid seems to synergize the action of the surfactants in rendering the fine coal particles contained in the froth more extractable from the water.

DOSAGE

The amount of surfactant or surfactant with hydrophobic liquid used to treat the froth based on coal present therein ranges from as little as 0.1 up to 3 lbs. per ton with a preferred dosage range being 0.05 - 1 lb. per ton.

EXAMPLES

To illustrate the invention, the following are presented by way of example.

A commercial coal slurry was used to conduct the tests. The slurry consisted of a water with the top layer being froth which was in the nature of a dry crusty layer. The coal contained in the froth was approximately of 325 mesh size. The plant from which the sample was obtained used a mixture of kerosene and MIBC as a frothing agent. The froth was subjected to centrifugation which, theoretically, separated the coal from the water and removed it from the froth. A typical sample after centrifugation showed three distinct layers: the bottom coal layer; a cloudy water layer; and an upper coal layer, which upper layer was in the form of a thick crust. This upper layer formed after centrifugation. It was not capable of being wet by water. A sample which contained this crusty layer was treated with 0.5 lb. per ton of a composition comprising approximately 74% by weight of mineral oil and 26% by weight of dioctyl sodium sulfosuccinate. After treatment, the crusty particles were wetted by water and could be removed from

the water by batch centrifugation. Using a conventional anionic polyelectrolyte of the type comprising an acrylamide 30% by weight acrylic acid having a molecular weight of about 2 million improved the rate of separation.

Similar tests were run using approximately 1 lb. per ton of a dodecyl benzene sulfonic acid sodium salt. This material was used both alone and blended with 60% by weight of kerosene. In both cases, the coal contained in the froth layer was rendered water-wettable.

The dioctyl sulfosuccinate-mineral oil composition was actually used in the plant process previously described. It did not work too well when used to treat the froth. It is believed this failure was due to short residence time of the coal slurry in the centrifuges designed for continuous operation. When samples were taken into the laboratory and batch centrifugation used, the coal fines were readily separated from the froth with no crusty layer being formed.